

Utility of Task-level Data for Business Process Reengineering Activities

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Task-based occupational analysis data can be readily adapted to the study of business process- and team-based organization of work activities; such systematic data can be particularly useful in the present rapidly changing world of work. The importance of task- or task module-level data is enhanced when valid and reliable estimates of various types of factors are obtained through automated procedures. Tasks and clusters of tasks are too fundamental to the way work is organized and perceived by workers to be laid aside in favor of abstract descriptors which ignore differential task and job knowledge and skill requirements.

There is currently a considerable tendency in the Industrial/Organizational Psychology academic arena as well as in the management literature to move away from detailed task analysis of work in favor of more general dimensions for the purposes of selection, test validation, and performance assessment (May, 1996 a-c). In a comprehensive and forward-looking paper on the nature and implications of the dramatically changing world of work, Cascio (1995) notes "the growing disappearance of 'the job' as a fixed bundle of tasks" (p. 930). He observes that work requirements for both workers and managers are beginning to exhibit a growing emphasis on core competencies that are "virtual, boundary-less, and flexible" (p. 930) to meet demands of customers and threats of competitors that are constantly changing. Cascio detects a shift away from a task-based toward a process-based organization of work that lends itself to the formation of autonomous work groups or process teams of varying size and duration. He states that workers today have to engage in continuous learning in order to adapt to changing circumstances and should be prepared for multiple careers. Thus, he asks:

What will be the future of traditional task-based descriptions of jobs and job activities? Should other types of descriptors replace task statements that describe what a worker does, to what or whom, why and how? Will 'task cluster' statements or 'subprocess' statements become the basic building blocks for describing work? What does a job description look like in a process-based organization or work? (p. 932).

We maintain that task-based job analysis remains not only relevant, but also necessary for a variety of uses, even in today's ever-changing work environment.

Flexible Approach to Task-based Job Analysis

If we begin with the notion that a task is the smallest unit of work that a worker normally uses to define what he or she does in the workplace, it would appear that tasks possess some very desirable measurement properties: (a) they represent well-defined homogeneous chunks of work that a worker can comprehend and reliably rate on one or more unidimensional scales; (b) they can be used as movable and replaceable components for defining or designing any job, process, or team effort at any moment in time. If changes occur in the composition of a job, process, or team, these changes will be most clearly detectable in terms of the removal, insertion, revision, or replacement of tasks.

Cascio (1995) suggests that dimensions of work other than tasks may become more important descriptors of work in the future -- such as environmental, contextual, social, and personal dimensions, in addition to the more traditional knowledge, skill, and ability dimensions (p. 932). However, we must first define the work requirements in terms of specific tasks in order to accurately assess the applicability of these dimensions. Otherwise, we are relying on general perceptions and hunches. To the extent that various dimensions can be linked to specific tasks or task clusters, work can be restructured to accommodate work requirements to the types of personnel available. Rather than considering dimensions such as abilities and interests, for example, as non-task dimensions, they should be treated as characteristics of tasks (or task clusters). This is accomplished by merging workers' biodata with their task response data from occupational surveys. Some of the biodata is obtained from a background section included in the occupational survey. Other biodata, such as aptitude or academic variables, are extracted from personnel files and merged with the survey biodata. It will then be possible to obtain average dimensional values for each task. For example, you might obtain the average pay grade level for each task based on the pay grade levels of those who perform the task. Similarly, you might compute the average interest or aptitude level for each task. Likewise, the percentage of workers who perform each task and use a given knowledge or tool may be computed, if these have been included as background items in the occupational survey. Tasks can then be clustered, not only on co-performance, but also on their profiles across a defined set of dimensions, such as knowledge, skills, and abilities (KSAs), to arrive at clusters of tasks

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with similar profiles. Tasks in the same co-performance cluster might be assigned as a functionally homogeneous unit of work. Tasks in the same KSA cluster represent feasible cross-training options or structural components in a restructured work environment.

In some instances, it may be desirable to obtain dimensional data on tasks directly, rather than through the cross-multiplication of biodata with task data. Important dimensions, such as task criticality, as measured by "consequences of inadequate performance," is best obtained for each task by having an appropriate number of subject matter experts provide ratings (as determined by interrater agreement criteria). If obtaining task-level ratings on a given dimension seems to be too labor intensive, such ratings might be obtained on task clusters instead, such as the co-performance or KSA-based task clusters described above. In order to support a process- or team-based approach for organizing work, the background section of the occupational survey will have to include variables that identify the team(s) the workers belong to and/or the process steps or subprocesses the worker is associated with. Thus, task-level data can be aggregated for a team or a process, and work relationships of workers assigned to a team or process can be analyzed and, if desired, be realigned according to worker characteristics identified in the biodata and associated task characteristics.

The ability to cluster tasks into meaningful clusters at higher and higher levels of aggregation to meet the needs of various levels of users highlights the flexibility of a system which obtains data at the most specific level that is feasible. Small chunks of task-level data can be aggregated to any level of generality that might be useful, but data gathered at a less specific level cannot be desegregated to answer questions requiring more specific data.

Automation of Occupational Analysis

If task-based occupational analysis as described above seems too cumbersome, too labor intensive, too static, recent developments in the Air Force's Comprehensive Occupational Analysis Programs (CODAP) software system have done much to alleviate such complaints. First of all, programs have been developed which automate much of the analysis process, including generation of products which greatly expedite the selection and interpretation of significant job types and task clusters from a hierarchical clustering of jobs or tasks. The core tasks and discriminating tasks within the selected clusters are identified for further analysis and reporting to manpower, personnel, and training managers.

Secondly, procedures have been developed for distribution of occupational surveys on disks to personal computers (PCs) worldwide, as well as the PC-based uploading of disk-transmitted data to create either a CODAP or ASCII output file. The PC-based, self-administration procedure allows tailored presentation of background and task items to raters (workers or subject matter experts) using probabilistic branching techniques to limit the number of items that need be presented. Feedback mechanisms have been incorporated in the Computer-Assisted Survey System which prompts the rater to evaluate and correct "suspicious" responses identified by algorithms embedded in the survey software. Thus, large amounts of task-level data obtained from thousands of workers can be analyzed with quick turnaround and relatively little administrative overhead (Albert, et al., 1994).

The automation of the process of distributing occupational surveys and the electronic capturing of response data allows the task-based approach to react rapidly to the changing world of work. Thus, it will be feasible to take frequent "snapshots" of the world of work, either on a periodic basis, such as a worker's birthday (continuous saturation sampling), or as a specific need arises (focused sampling). Specific needs may also require updated survey instruments. Rapid revision of survey instruments will, of course, be no problem in an automated environment. It is evident that the computerization of the entire survey development, distribution, response capturing, and analysis process has converted the task-based occupational analysis process from a cumbersome dinosaur to a dynamic, interactive, flexible process capable of keeping pace with a dramatically changing world of work.

One area in which the PC has made an important contribution is in the application of complex scaling procedures for rating tasks. In particular, the PC has made it possible to obtain from workers estimates of absolute time spent on tasks that are more valid and reliable than those derived from four competing scales: a relative time spent scale, a direct magnitude estimation scale, an indirect magnitude estimation scale, and an end-anchored graphical scale. Descriptions of the scales and research findings are reported in Albert et al. (1995) and Phalen (1995).

The Absolute Time Spent (ATS) Scale

The amount of time a worker spends performing a task is a complex concept composed of two less complex components that are more psychologically manageable: frequency of task performance during a specified period of time and the amount of uninterrupted time it normally takes the worker to perform the task once. Frequency

estimation has proved to be especially accurate and reliable. The estimation of time is more subject to influences in the rater's internal and external environments; however, the estimation of time for a single performance of a task is a well-defined event of limited scope. Once accurate and reliable estimates of frequency and time to perform a task once have been obtained, the total amount of time spent within a specified period is nothing more than the cross-product of the two component measures rescaled to a common metric.

The measurement of total absolute time spent (ATS) and its component subscales of "frequency of task performance" and "time to perform a task once" are an integral part of the Air Force's PC-based Computer-Administered Survey Software (CASS) system (Albert, et al., 1995). All estimates of frequency and time are provided by the rater in natural language form by selecting codes and inserting numeric values. While previous approaches used to estimate ATS have been plagued with problems of overestimation, the CASS system has been able to incorporate a number of operationally tested features that seem to have largely overcome this problem (Phalen, 1995).

Overall, the CASS system has been found to be easy to use and reliable (average coefficient for individual raters over a two-to-four-week period = .66). Also, raters have selected ATS scale estimates as significantly more valid than those of the four alternative scales (a value of $p < .001$ was associated with most of the computed Chi-square values). Upon completion of a survey administration, the total absolute time spent vector, as well as its subscale vectors, are immediately available on floppy disk as a data file.

From an organizational analysis standpoint, there is much to be gained from the information provided by the component subscales of the ATS estimation procedure, as follows:

- (1) The "frequency of task performance" subscale could be used as a measure of the need for refresher training. Infrequently performed tasks that have high hazard potential or serious consequences if performed inadequately may require occasional refresher training. On the other hand, the occurrence of mishaps and accidents may be related to either low or high frequency of performance, and this may vary from task to task.
- (2) The "time to perform a task once" subscale also has numerous applications that should be of interest to organizational analysts. The average amount of time it takes various functional subgroups of workers to perform specific tasks at various grade or experience levels could be used to set standards for these groups and the various levels within groups. On the other hand, if certain individuals within a group are requiring much more time or much less time to perform these tasks, chances are that the high-time workers may need training or motivation, while the low-time workers may either not be doing the task as it should be done or have valuable timesaving expertise that should be tapped. The average length of time it takes entry-level personnel to perform specific tasks, together with the associated standard deviations, might be used to set bypass criteria and standards for OJT or formal training.
- (3) Significant differences in task performance times between selected subgroups might indicate that the task in question is not really the same task for the various subgroups. This could occur, for example, if the subgroups represent equipment operators or repairmen on different aircraft types who rate many of the same task statements.
- (4) The effectiveness of two different training environments could be compared by determining how long it takes the average worker trained in either environment to perform specific tasks soon after beginning the same entry-level job.
- (5) Perishability of skills for specific tasks could be determined by computing the functional relationship between the frequency with which specific tasks are performed and the time it takes workers with similar background characteristics to perform these tasks.
- (6) Work descriptions for individuals and groups would be a much richer source of information if the "frequency of task performance" and "time to perform a task once" data were shown together with the total (cross-product) ATS values. Clustering of work descriptions would provide clearer and more meaningful results if all three vectors of data were clustered as one profile, using a common metric, or as the average of three overlap matrices.

Conclusions

This paper has attempted to show that task-based occupational analysis can be readily adapted to process- and team-based organization of work, even in a rapidly changing world of work. It has also attempted to show the enhanced importance of task data when valid and reliable estimates of absolute time spent on tasks are obtainable through automated procedures. The "task" is much too basic to the way work is organized and thought about by

workers to be laid aside in favor of less fundamental, more abstract descriptors.

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